PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Process for the Preservation of Wood with Copper and Arsenic Compounds.

I, SOSTI KANNESAM, B.E. (Mech.), M.E. (Hons.), A.M.I.E., a British Subject, of New Forest P.O., Dehra Dun, U.P., India, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The object of the present invention is effectively to fix copper and arsenic simultaneously in wood, strawboards, palmis and other materials containing cellulose and/or lignin so that when the materials are exposed to moisture or running water, practically, neither copper nor arsenic is washed out of the materials, and the strength of the wood treated with the proposed preservative is not appreciably affected by the chemical solution.

In this connection it may be mentioned that British Patent No. 2972/1912 states that metallic salts offer resistance to being washed out of the wood impregnated into them by the addition of water soluble chromium compounds. Although wood preservatives comprising mainly copper and chromium compounds are known, as far as I am aware, there has been no proposal made to the mixture containing mainly or solely of copper, arsenic and chromium compounds especially in the proportions I have found to be most suitable for wood preservative purposes. Though containing copper the preservative is neither decomposed by nor is it corrosive to steel and iron.

It has been proposed to use other organic and/or inorganic salts in admixture with chromic acid or chromium salts with or without arsenic compounds, see, for example, (1) the Indian Specification No. 17,229 of 1930, in which it is proposed to use 45 parts of $K_2Cr_2O_7$, 50 parts of NaF and 5 parts of dinitro-phenol with or without arsenic compounds, and (2) the British Specification No. 377,441 in which it is proposed to use solely or almost solely arsenic and chromium salts. So far as I am aware, it has hitherto not been proposed to use chromium compounds with copper and arsenic compounds as main wood preserving ingredients for fixing simultaneously both the copper and arsenic radicals. By the expression "main ingredients" it is meant that the copper, arsenic and chromium compounds together should not be less than 80%. According to my invention, I propose to use chromium in the form of water-soluble chromium compounds along with water-soluble copper and arsenic compounds as the main ingredients of the wood preservative. If trivalent arsenic compounds are used, chromates or dichromates cannot be used in solution with them owing to the reducing action of the latter, chromic acid can, however, be employed in which case the damage due to the corroding action of the solution on iron or steel vessels used in commercial wood preservation is avoided. Moreover, such a preservative can be used for painting wood so that a surface protection is obtained. According to an important feature of my invention, chromium constitutes between 20% and 90% of the total copper arsenic and chromium, calculated in terms of the elements, present in the solution. Within the above range, I detected certain novel technical effects never observed before with regard to the simultaneous fixation of copper and arsenic in wood as will be evident from the description of the invention given below. The facts on which my present invention is based can be understood from the following table in which are given the data indicating the phenomenon which forms the basis of my invention.

No. of experiment.	Percentage concentration of chemical in solution.			Percentage of chemical (estimated on the original quantity injected) leached out after 20,000 shakes in 100 c.c. of water.	
	Copper sulphate.	Arsenic pentoxide.	Potassium di-chromate.	Copper sulphate.	Arsenic pentoxide.
1	1.0	1.0	0.5	10.5	32.2
2	1.0	1.0	0.5	11.0	35.1
3	1.0	1.0	0.5	—	39.0
4	1.0	1.0	1.0	5.3	24.7
5	1.0	1.0	1.0	5.1	24.4
6	1.0	1.0	1.0	—	25.0
7	1.0	1.0	1.5	traces	19.4
8	1.0	1.0	1.5	traces	18.1
9	1.0	1.0	1.5	—	17.5
10	1.0	1.0	2.0	nil	15.6
11	1.0	1.0	2.0	nil	12.4
12	1.0	1.0	2.0	—	11.5
13	1.0	1.0	2.5	nil	7.6
14	1.0	1.0	2.5	nil	7.6
15	1.0	1.0	2.5	—	4.6
16	1.0	1.0	3.0	nil	4.4.
17	1.0	1.0	3.0	nil	4.4
18	1.0	1.0	3.0	—	2.5
19	1.0	1.0	3.5	nil	2.5
20	1.0	1.0	3.5	nil	2.5
21	1.0	1.0	3.5	nil	2.8
22	1.0	1.0	4.0	nil	traces
23	1.0	1.0	4.0	nil	traces
24	1.0	1.0	4.0	nil	traces.

The experiments, of which the results are shown in the table were carried out as follows:—

Small pieces of air-dried semul wood (Bombax malabaricum) were impregnated with wood preservative solution containing the chemicals, as shown in the table, under test; in each case, a known concentration of either or both of the chemicals was used. As the amount of the solution absorbed by the wood piece in each case was known by weighing the piece before and after the impregnation, the amount of arsenic, copper or/and chromium compounds injected into the wood could be calculated.

The pieces after impregnation were dried and shaken in bottles containing 100 c.c. of distilled water in each case. The amount of arsenic and copper compounds washed out in each case into the water was determined by analysis, and is noted in the table as a percentage of the original amount injected into the wood piece. I have made experiments with two conifers and four hard woods in this connection. Instead of applying equal proportions of copper sulphate and arsenic pentoxide, I have made experiments to test the fixation of copper and arsenic when copper varies between 8% and 49% and when arsenic varies between 8% and 50% of the total copper, arsenic and chromium present as elements. The bottles were shaken in a special shaking machine for 20,000 times.

It may be added that the weight of solution absorbed by the wood pieces was about 50% to 90% of their untreated weight.

It will be seen from the results of the experiments indicated in the table that copper is fixed to the wood when a relatively low proportion of chromium is used, whereas for the fixation of arsenic in wood a relatively higher proportion of chromium salts appears to be necessary. Also, other experiments conducted by me showed that less chromium is required for fixing copper and more chromium is required for fixing arsenic in wood when copper and arsenic were present in the impregnating solution than when they are individually—to the exclusion of the other—in wood. Also, when a mixture of copper, arsenic and chromium salts are injected into wood, the chromium is used for the fixation of copper before any considerable fixation of arsenic can take place, during which process a further fixa-

tion of copper proceeds. The practical result of such a phenomenon is that, if the chromium required for fixing copper as well as arsenic is slightly less than it should be, the copper is not leached out, but there is a danger of a considerable proportion of the arsenic being washed out of the wood. Again, my experiments have shown that copper cannot be fixed in wood to the same degree as arsenic without considerably reducing its toxicity so that the arsenic present should be as little as is necessary to resist fungus attack. My experiments have shown that the copper radical is fixed in wood more efficiently than arsenic for a certain quantity of chromium present and, as wood eating insects, like white ants, contain more acid than fungi, the copper will still be effective against such organisms, whilst arsenic will mostly cope with fungi against which it is very toxic even for a high degree of fixation in wood. The chemical basis for such an affinity for copper in preference to arsenic by wood when both copper and arsenic are present in the presence of chromium salts is a fact that is new to the best of my knowledge.

My present invention is based on the fact that, when soluble copper and arsenic compounds, in conjunction with chromium salts in aqueous solution, are used for impregnating different timbers, there is a certain critical ratio between, firstly, copper and chromium and, secondly, between arsenic and chromium above which only arsenic is washed out, or neither arsenic nor copper is washed out. In the case of hardwoods containing gums, oleo-resins, a higher percentage of chromium salts is, in general, necessary for the fixation of copper and arsenic in wood. It may be noted that as regards toxicity to wood destroying fungi, copper and arsenic are to a large extent supplementary. If copper sulphate and arsenic pentoxide are used, very good results can be obtained by using two to four times as much copper sulphate (crystals) as arsenic pentoxide. In other words, there are certain fungi like Lenzites sp. to which arsenic is not very sensitive while copper is sensitive. There are again fungi like Coniophora sp. to which arsenic is very sensitive, but copper is not quit so toxic. Again, in the case of insects, especially termites, copper appears to be almost as toxic as arsenic. From my observations, I find that copper with arsenic prevents the growth of moulds on wood.

In practice, wood may be preserved by the injection, under pressure, of the composite solution in closed vessels, or dipping in open vessels or by brush or spray painting of the solution.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A wood preservative consisting mainly or solely of water soluble chromium, copper and arsenic compounds.

2. A wood preservative according to Claim 1, in which the chromium content varies between 45% and 90% of the total copper arsenic and chromium present as elements.

3. A wood preservative according to Claim 1, in which the copper content varies between 8% and 40% of the total copper, arsenic and chromium present as elements.

4. A wood preservative according to Claim 1, in which the arsenic content varies between 8% and 50% of the total copper, arsenic and chromium present as elements.

5. A wood preservative according to the preceding Claims, in which the arsenic compounds are present in the form of water soluble arsenates or as As_2O_5.

6. A method of preserving wood by impregnating with compositions according to any of the preceding Claims.

7. Wood when treated with compositions according to Claims 1 to 6.

Dated this 15th day of May, 1933.

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